II. *An Account of an Experiment, touching the Quantity of Air produced from a certain Quantity of* Gunpowder *Fired in common Air; by Mr.* F. Hauksbee, *F. R. S.*

I Took a fine Glaſs Tube about 36 Inches long, the Diameter of its Bore about three quarters of an Inch: Its upper Orifice had a Braſs Ferrel ſoder'd to a Screw cemented on it, to which was ſcrew'd a Cock. The lower or bottom part was naked and open (without the Bladder made uſe of when I made the Experiment before the Society, for I ſince found that to be needleſs): near the upper part of this Tube within, was fixt a piece of Cork, noch'd on it Edges, to give the greater liberty for the Exploſion to vent it ſelf. The Cork had a ſmall Cavity in its middle, the better to receive and hold the *Gunpowder*, which was let down on it, through a ſmall Glaſs Funnel, before the Cock was ſcrew'd on. In this manner the lower Orifice was plung'd under the Surface of a Veſſel of Water; the Cock being then ſcrew'd on and open, it was eaſie, by ſucking at it with ones Mouth, to remove the inward Air, whereby the Preſſure of the outward Air would raiſe the Water in it to any determinate height. The Tube before being meaſured by an accurate Cubical Inch, and graduated by a File on its outſide. When the Water had aſcended to the deſign'd Mark by the prementioned Means, the Cock was turn'd, which ſuſpended it there: Then the Focus of a burning Glaſs being caſt on the Powder, it ſoon fir'd, blowing the Water down violently, but ſuddenly riſing again, reſted ſo much below the Mark it ſtood at before firing, as was equal to the Quantity of ſeeming Air produced from it. The quantity of *Gunpowder*, uſed in this Experiment, was one exact Grain Weight; and I found the quantity of ſpace the Water had deſerted, juſt after the Exploſion, was equal to the bulk (nearly) of a Cubical Inch of *Gunpowder*, whoſe Weight was 222 Grains: So that 222 Grains Weight of the ſame Powder, as ſoon as fir'd, ſeems to produce ſomething to poſſeſs the ſpace of ſo many Cubical Inches of Air. Now whether the ſpace deſerted by the Water is poſſeſs'd by a Body of the ſame Weight and Denſity, or is of the ſame quality of common Air, I dare not determine; Since an Experiment I have lately made, to try how much the heat produced by the Exploſion of the *Gunpowder*, might contribute to the largeneſs of the ſpace diſpoſſeſs'd by the Water, ſeems to conclude it otherwiſe. For I found that when the *Gunpowder* had been fir'd an Hour, the Water had aſcended about $\frac{2}{20}$ of the whole deſerted ſpace, which was in length about 2 $\frac{1}{2}$ Inches, and was equal to about a Cube Inch in quantity: The ſpace in length was divided into 20 equal parts; at two Hours after firing, it had aſcended near $\frac{4}{20}$ of the ſame. *By* that time I judg'd it might become of an equal degree of Temperature with the outward Air: But ſtill continuing the Experiment, I found (to my great ſurprize) that two Hours after the laſt Obſervation, the Water had reach'd to about $\frac{6}{20}$. Next Morning, which was at about 18 Hours diſtance, I took notice it had arrived to near $\frac{10}{20}$, or half of the firſt deſerted ſpace. Thus continuing riſing, I found that at the end of 12 Days, the Water had aſcended ſomething above $\frac{17}{20}$ of the ſame. At 18 Days it had arrived to 19 of the 20 parts at firſt deſerted; and at that Station it continued without alteration for 8 Days: So that the ſeeming real Air, produced from the fir'd Grain weight of *Gunpowder*, was equal but to the bulk of 11 Grains of the ſame; that Number being nearly the 20th part of 222, the Number of Grains contain'd in a Cubical Inch,as aforeſaid. Which ſhews that the whole ſpace at firſt deſerted by the Water upon firing the *Gunpowder*, was not ſupply'd with real Air. The Temperature of the Air I all along conſidered, and found it contributed nothing to this odd Phænomenon, which how to account for I know not; I only ſuggeſt, that the Springs, or Conſtituent parts of the Ambient Air, as well as thoſe contain'd in the Body of the *Gunpowder*, may, upon firing, be capable of being broken, or at leaſt ſo Diſtended, as to poſſeſs ſo large a ſpace, and require ſo long a time to recover their Natural State again. And this, I preſume, could never have been diſcover'd but by the confinement of the ſame Air in which the Exploſion was made.

And as this Diſcovery is altogether new, ſo the Application of it may be as uſeful. But I ſhall wholly leave that to this Honourable Society, who beſt know how, moſt aptly to apply it.

Notwithſtanding the Account of this Experiment ſeems to Run-counter with the Accounts formerly given of the firing of *Gunpowder* in *Vacuo*; yet conſidering the different Mediums in which the Experiments were made, they may be the eaſier reconcilable: For when the *Gunpowder* was fired in ſo thin a Medium as the near approach to a *Vacuum*, that then the remaining Air in the Receiver could ſuffer by the Exploſion, but in proportion to the Quantity, which muſt be ſo inconſiderable, as not to be taken notice of. Beſides, when I come to repeat thoſe Experiments, I doubt not but I ſhall diſcover ſome Occurrences that were then paſt by unheeded, that may render them more agreeable to this laſt, than they now ſeem to appear.

III. *An*